

REMARKS

This Preliminary Amendment cancels, without prejudice, claims 1 to 12 in the underlying PCT Application No. PCT/EP2004/001660 and adds new claims 13 to 26. The new claims, inter alia, conform the claims to United States Patent and Trademark Office rules and does not add any new matter to the application.

In accordance with 37 C.F.R. § 1.125(b), the Substitute Specification (including the Abstract) contains no new matter. The amendments reflected in the Substitute Specification (including Abstract) are to conform the Specification and Abstract to United States Patent and Trademark Office rules or to correct informalities. As required by 37 C.F.R. §§ 1.121(b)(3)(ii) and 1.125(c), a Marked-Up Version of the Substitute Specification comparing the Specification of record and the Substitute Specification also accompanies this Preliminary Amendment. Approval and entry of the Substitute Specification (including Abstract) are respectfully requested.

The underlying PCT Application No. PCT/EP2004/001660 includes an International Search Report, dated June 4, 2004, a copy of which is included. The Search Report includes a list of documents that were considered by the Examiner in the underlying PCT application.

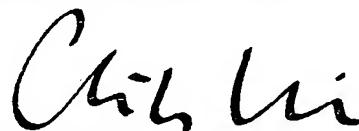
The underlying PCT Application No. PCT/EP2004/001660 also includes an International Preliminary Examination Report, dated February 25, 2005. An English translation of the International Preliminary Examination Report is included herewith.

It is respectfully submitted that the subject matter of the present application is new, non-obvious and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,

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TRANSMITTER HEAD AND SYSTEM FOR
CONTACTLESS ENERGY TRANSMISSIONFIELD OF THE INVENTION

The present invention relates to a transmitter head and a system for contactless energy transmission.

5 BACKGROUND INFORMATION

[[DE]] German Published Patent Application No. 100 53 373
[[A1]] describes a device for contactless energy transmission.
In that case, in which a transmitter head is described which
permits inductive energy transmission and has a number of
10 turns per unit length.

[[DE]] German Published Patent Application No. 44 46 779
[[C2]] and [[DE]] German Published Patent Application No.
197 35 624 [[C1]] describe a system for contactless energy
15 transmission, in which the path is made up of a stationary
neutral conductor, and an aluminum profile as a return line.
The neutral conductor is surrounded by a U-shaped core of the
transmitter head, the core being movable along the neutral
conductor. A winding is provided on the U-shaped core. All
20 in all, the The transmitter head requires may require a large
unit volume.

PCT International Published Patent Application No. WO 92/17929
likewise describes a system for contactless energy
25 transmission, in which the transmission path is made up of a
forward line and a return line in the form of line conductors.
In this case, the The transmitter head implemented with an E-
shaped core and a winding disposed on the middle limb of the
E-shaped core likewise requires may require a large unit
30 volume.

[[DE]] German Published Patent Application No. 197 46 919

[[A1]] describes a flat arrangement which, however, ~~results~~
may result in low efficiency in the energy transmission.

5 SUMMARY

Therefore, the object An example embodiment of the present invention is to further develop may provide a system for contactless energy transmission in such a way that it requires which may provide a smaller unit volume in an inexpensive and

10 uncomplicated manner.

According to the present invention, the objective is achieved with respect to the transmitter head by the features specified in Claim 1 or 2, and with respect to the system by the

15 features specified in Claim 12.

Essential features of the present invention with respect to the transmitter head are that the The transmitter head for a system for contactless energy transmission includes may

20 include a support connected to at least one ferrite core, the ferrite core being at least partially E-shaped, and the flat winding being disposed about one limb of the E. In particular, the The transmitter head is designed may be adapted for an electrical energy-transmission device having a

25 primary-conductor arrangement made of at least two primary conductors running extending parallel to each other and at least one secondary-winding arrangement, electromagnetically coupled thereto, which is mechanically separated from the primary-conductor arrangement and is movable in its

30 longitudinal direction; the The secondary-winding arrangement has at least one secondary coil which is in the form of a flat winding and which lies is arranged in a plane situated parallel to the plane accommodating the primary-conductor arrangement; the The transmitter head includes a

35 support connected to at least one ferrite core, the ferrite

core being at least partially E-shaped, and the flat winding being provided about one limb of the E-shaped ferrite core.

5 ~~In this context, it is advantageous that the~~ The transmitter head ~~is~~ may be very flat, may be cost-effective, and ~~requires~~ may require a small unit volume. In addition, the efficiency of the energy transmission ~~is~~ may be much higher, since the E-shaped design conducts arrangement may conduct the field lines in such a way that fewer stray fields may develop, and the 10 majority of the field lines generated by the primary lines ~~is~~ or conductors may be conducted through the ferrite core having the limbs of the E.

15 ~~In one advantageous embodiment, the~~ The primary conductors are may be formed as line conductors, or the primary conductors are may be formed as flat conductors whose surface normal is perpendicular to the plane accommodating the secondary-winding arrangement. ~~In this case, it is advantageous that high~~ High current densities are may be achievable, litz-wire material is 20 may be useable, and therefore the skin effect ~~is~~ may be reducible.

25 ~~In one advantageous development, the~~ The secondary-winding arrangement ~~is~~ may be disposed at the lower side of the floor of a vehicle. This has the advantage may provide that a rail system is useable in the same way manner as a system without rails.

30 ~~In one advantageous refinement, the~~ The secondary-winding arrangement ~~is~~ may be embedded in a potting or casting compound. This offers the advantage may provide that a high degree of protection is attainable.

35 ~~In one advantageous development, the~~ The primary-conductor arrangement ~~is~~ may be disposed in stationary manner in the

near-surface region of a travel path. The advantage here is This may provide that high efficiency is may be attainable in the energy transmission.

5 In one advantageous refinement, the The primary-conductor arrangement and/or the secondary-conductor arrangement is/are may be formed at least partially of litz-wire material. The advantage here is This may provide that it is may be possible to reduce the skin effect.

10 In one advantageous embodiment, the The flat winding is may be implemented as a conductor track on a single-layer or multilayer board. This offers the advantage may provide that it is may be possible to produce the transmitter head 15 particularly inexpensively.

In one advantageous development, the The board is may also be fitted with electronic components. The advantage in this case is This may provide that the number of components is may be 20 reducible, in particular e.g., the number of means devices for electrical and/or mechanical connection is may be reducible.

In one advantageous refinement, the The board is may be connected to a housing part encompassing a cooling device. In 25 particular, the cooling device has cooling fins and/or cooling fingers. This is advantageous in may provide that the heat is may be able to be transmitted from the housing part to the cooling device.

30 Essential features of the present invention Features hereof with respect to the system for contactless energy transmission using a transmitter head as recited in at least one of the preceding claims are may include that two line conductors are laid in the floor with a mutual distance A, the distance of 35 the transmitter head from the floor being between $0.05 * A$ and NY01 1042651

0.2 * A. This offers the advantage may provide that great powers are may be able to be transmitted, accompanied by particularly small unit volume.

5 Further advantages are yielded from the dependent claims.

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List of Reference Numerals

LIST OF REFERENCE NUMERALS

- 1 Support
- 2 Ferrite cores
- 5 3 Layer of a multilayer board
- 4 Layer of a multilayer board
- 5 Layer of a multilayer board
- 21 Housing part
- 22 Cooling fins
- 10 23 Electronic components
- 24 Ferrite cores
- 25 Winding
- 26 Board
- 31 Ferrite core
- 15 32 Plastic molded part
- 33 Litz wire
- 41 Floor
- 42 Line conductor
- 43 Housing part
- 20 A,B Distance

The Example embodiments of the present invention will now be ~~are~~ explained in more detail with reference to figures: the appended Figures.

5 BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1a is a schematic view of a transmitter head of an example embodiment of the present invention.

10 Figure 1b is an enlarged view of a left end area of the transmitter head illustrated in Figure 1b.

Figure 2 is a schematic view of an entire structure of a transmitter head together with a board bearing a winding.

15 Figure 3 is a schematic view of an example embodiment of the present invention.

Figure 3a is a schematic view of an example embodiment of the present invention.

20 Figure 4 is a schematic view of a part for inductive energy transmission of a system.

DETAILED DESCRIPTION

25 Figure 1a shows illustrates a transmitter head of an example embodiment of the present invention, an enlarged section of the left end area being shown illustrated schematically in Figure 1b. It is may be flat and needs may need a small unit volume.

30 Ferrite cores 2 are mounted on and connected to support 1, using, in particular for example, an adhesive connection or a releasable connection such as a screw connection ~~or the like, etc.~~

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Provided at ferrite cores 2 is a multilayer board having layers (3, 4, 5) which bear copper conductor tracks that take the form of flat windings, and thus are implemented on the board.

5

In another an exemplary embodiment of the present invention, a single, planar, spiral winding ~~is~~ may be provided as a conductor track of a single-layer board, less electrical power then being transmittable, however.

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In other exemplary embodiments of the present invention, ~~particularly according to such as illustrated, for example, in~~ Figures 1a and 1b, a multilayer board (3, 4, 5) is used that has a spiral winding in several planes. In that case, ~~in~~ 15 ~~particular~~ for example, the current conduction runs not only in a single, spiral, specific plane, but rather the conduction changes repeatedly between the planes to reduce the skin effect. That means that ~~advantageously~~, after a short conductor-track section, a change is made to a next plane of 20 the board; ~~there~~. There, a short conductor-track section is traversed again, and then in turn a change is made. In this way manner, a quasi-twisted current conduction is obtained which, as far as the basic principle is concerned, corresponds to a litz wire, thus, a multiple bundle of mutually insulated 25 current leads. The winding thus obtained is therefore quasi-twisted.

Figure 2 shows illustrates the entire structure of the transmitter head together with board 3 bearing the winding. 30 Board 3 also bears electronic components 23 and has the necessary conductor tracks.

Board 3 and ferrite cores 4 are joined to a housing part 21 that also has cooling fins 22 for heat dissipation.

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Figure 3 shows a further illustrates an exemplary embodiment according to the present invention. In this case, disposed Disposed on ferrite core 31 are plastic molded parts 32, in whose depressions, litz wires 33 are embedded. The litz wires 5 are missing in Figure 3a. In the left upper half of Figures 3 and 3a, a symbolic intersection through plastic molded parts 32 is shown illustrated, with the indication of two inserted litz wires 33. Plastic molded parts 32 facilitate the insertion of litz wires 33. Ferrite core 31 is E-shaped, and 10 the winding is implemented about the middle limb of the E. The three limbs of the E are very short, particularly e.g., as short as the height of the winding.

Figure 4 shows illustrates the part for the inductive energy 15 transmission of the system. Embedded in floor 41 are two line conductors 42, constructed from litz wire, which have a mutual distance A of, e.g., 140 mm. In other exemplary embodiments of the present invention, values from 100 mm to 200 mm are also advantageous may be provided.

20 The flat transmission head, provided in a housing part 43, has a maximum distance B to floor 41 of, e.g., 15 mm, thus approximately one tenth of distance A of the line conductors. Instead of a tenth, values between 7% to 12% are advantageous 25 may be possible.

These indicated geometric features are may be achieved in the present invention by designing arranging the winding to be flat. The lines of the winding lie are in one plane and do 30 not cross over each other.

In other exemplary embodiments of the present invention, plastic molded parts 32 are designed arranged as modules able to be joined to one another, whose depressions are formed in 35 such a way that the litz wire is either insertable into

straight lines or into circular-arc pieces. To that end, both the straight and the circular-arc-type shapes are impressed as depression into the original plastic part in such a way that protuberances remain which are partially interrupted relative 5 to each other, thus do not all directly connect together.

The transmitter head is may be incorporated in a vehicle or machine part (not shown in the figures) which is relatively movable with respect to the floor.

10 The system of the present invention for contactless energy transmission advantageously operates may operate according to the electronic and electrical features indicated described,
for example, in [[DE]] German Published Patent Application No.
15 44 46 779 [[C2]], [[DE]] German Published Patent Application
No. 100 53 373 [[A1]] and/or [[DE]] German Published Patent
Application No. 197 35 624 [[C1]], and is may be
correspondingly designed. In contrast to these documents,
however, the power transmission, especially e.g., the
20 transmitter head, is may be implemented with particularly
small unit volume.

ABSTRACT

A transmitter head for a system for contactless energy
transmission includes a support connected to at least one
ferrite core. The ferrite core is embodied at least partially
5 in the E-form and a flat winding is arranged around one leg of
the E.